DISTRIBUTION AND ABUNDANCE OF EARED GREBES (PODICEPS NIGRICOLLIS) IN BRITISH COLUMBIA

Andre M. Breault
Kimberly M. Cheng
Jean-Pierre L. Savard

TECHNICAL REPORT SERIES No. 51
Pacific and Yukon Region 1982
Canadian Wildlife Service

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Andre M. Breault[1]
Kimberly M. Cheng[2]
Jean-Pierre L. Savard[3]

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This series may be cited as:

Breault, A.M., K.M. Cheng and J-P.L. Savard.
Distribution and abundance of Eared Grebes
(Podiceps nigricollis) in British Columbia.
Technical Report Series No. 51.
Canadian Wildlife Service, Pacific and
Yukon Region, British Columbia.

1 Department of Zoology, University of British Columbia, Vancouver, B.C. V6T 2A9
2 Department of Animal Science, University of British Columbia, Vancouver, B.C. V6T 2A2.
3 Canadian Wildlife Service, P.O. Box 340, Delta, B.C., V4K 3Y3

93-00184/

Published by Authority of the
Minister of Environment
Canadian Wildlife Service

Minister of Supply and Services Canada 1988
Catalogue No. CW69-5/12E
ISBN 0-662-15094-5
ISSN 0831-6481

Copies may be obtained from:
Jean-Pierre L. Savard
Canadian Wildlife Service,
Pacific and Yukon Region
P.O. Box 340,
Delta, British Columbia,
Canada V4K 3Y3

ABSTRACT

The historic and current distribution of breeding Eared Grebes (Podiceps nigricollis) in British Columbia is summarized. Nesting records were found for 46 lakes. Current distribution was studied in 1985 and 1986, when 419 lakes in 4 selected regions (Central Interior, Southern Interior, Peace River and Okanagan/Kamloops) were surveyed. Thirty-four lakes with previous breeding records were revisited. Only 19 were still used by breeders. Twenty-seven new breeding lakes were discovered. Most lakes and most breeders were found in the Central Interior. Breeding populations ranged from 1 to roughly 500 pairs per lake. The total breeding population on all surveyed lakes approached 3,000 pairs. Due to a few large breeding lakes, the Peace River and the Southern Interior jointly accommodated 50% of the known provincial population, even though they comprised only 20% of the breeding lakes. A reduced number of breeding lakes and breeders was found in the Okanagan/Kamloops region.

RESUME

Ce rapport fait le point sur la distribution historique et actuelle des Grèbes a Cou Noir en Colombie-Britannique. Des évidences de nidification furent obtenues pour 46 lacs. La distribution actuelle fut étudiée lors de recensements conduits en 1985 et 1986 sur 419 lacs dans 4 régions différentes (l'Intérieur Centre, l'Intérieur Sud, la Rivière La Paix et l'Okanagan/Kamloops). Trente-quatre lacs avec évidences historiques de nidification furent revisités. Seulement 19 de ces lacs supportaient encore des oiseaux nicheurs. Vingt-sept nouveaux lacs utilisés par des oiseaux nicheurs furent identifiés. La population provinciale totale approche 3000 couples. La plupart des lacs et des adultes reproducteurs se retrouvent dans l'Intérieur Centre. Du à la présence de quelques lacs supportant un nombre

élevé d'oiseaux, les régions de la Rivière La Paix et de l'Intérieur Sud renferment 50% de la population provinciale connue, dans 20% du nombre total de lacs de nidification. Peu de lacs de nidification et peu d'adultes nicheurs sont présent dans la région de l'Okanagan/Kamloops.

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ACKNOWLEDGEMENTS

This project would not have been possible without the cooperation of many people and many organizations. We want first to thank the people who contributed to the field work. They are, in alphabetical order: Christine Beaudoin, Sean Boyd, Ron Boychuck, Wayne Campbell, Catherine Choquette, John Eadie, Bob Emery, Gilles Gauthier, John Gross, Ted Miller, Bryan Nuttall, Emma Neill, Sylvia and John Rose, Phil Ranson and Jamie Smith. We also thank Les Willis for producing the maps of British Columbia and the secretarial staff of the Canadian Wildlife Service for typing the various manuscripts. Additional support was provided by many organizations. We wish to thank the Royal British Columbia Museum for giving us access to the B.C. Nest Records Scheme. The biological staff of the Williams Lake, Prince George and Kamloops offices of Ducks Unlimited (Canada) shared their area knowledge. The Department of National Defense granted us permission to undertake wetland surveys on their property. The World Wildlife Fund (Canada), the Canadian Wildlife Service University Research Support Fund and the NSERC operating grant to K.M. Cheng provided financial support. The B.C. Federation of Naturalists and the Williams Lake Naturalist Club published and distributed questionnaires about breeding Eared Grebes in their respective newsletters. Finally, we want to acknowledge the logistic support provided by the Canadian Wildlife Service. Gratidude is also expressed to the many reviewers of earlier drafts of this report: Jamie Smith, Rob Butler, Steve Wetmore, Sean Boyd and Rick McKelvey. This work is part of a larger project on coloniality in Eared Grebes conducted at the University of British Columbia for the requirements of the Masters of Science program.

INTRODUCTION

Eared Grebes (Podiceps nigricollis) nest in colonies ranging in size from a single pair to thousands of individuals (Palmer 1962). They are also gregarious in winter and on various staging points during migration. Concentrations of over 20,000 have been observed on Malheur Refuge, Oregon during spring migration (Palmer 1962). Each fall, some 750,000 birds concentrate on Mono Lake, California for their wing moult (Cooper et al. 1984, Storer and Jehl 1985, Winkler and Cooper 1986) and over half a million birds winter on the Salton Sea in California (Palmer 1962). Their gregariousness on breeding and wintering grounds makes large numbers vulnerable to local catastrophes.

Except for Munro (1941) and McAllister (1958), little information is known on the breeding biology and the status of Eared Grebes in British Columbia. Almost no information is available on reproductive biology in other parts of North America. That lack of information caused the Canadian Wildlife Service (Pacific and Yukon Region) to rank Eared Grebes amongst the top 15 species needing study in its priority migratory bird species list (Boyd 1982).

In British Columbia, most known colonies are located in the Central Interior and the Peace River Region (Campbell 1978). Preferred nesting habitat consists of shallow, highly productive water bodies providing nest cover and an abundance of aquatic invertebrates (Cramp and Simmons 1977). Those conditions are found only in certain lakes and might limit breeding distribution. Fluctuations in breeding numbers can arise from three main causes:

1. Natural variations in water levels

Seasonal water level fluctuations may flood, destroy or expose to predation whole Eared Grebe colonies (Munro 1942, Cramp and Simmons 1977).

The frequency and biological significance of those events has not been studied.

2. Man-caused alterations of breeding habitat

A) Impact of oil exploration

In addition to drilling sites, sometimes located on Eared Grebe breeding lakes (e.g. Boundary Lake), oil exploration also involves the construction of access roads, increased accessibility to the public, and sulphur releases at drilling sites. Impacts of those have not been documented, but could have adverse effects on breeding success.

B) Ranching practices

Wetlands can be drained to create sedge meadows and pasture areas, resulting in the elimination of potential or existing nest sites. If nests are not directly destroyed while cattle are drinking, disturbance caused by cattle could cause nest desertion.

C) Agricultural practices

Farmlands can be created by draining wetlands, and water from wetlands can be used for irrigation. This can result in either complete disappearance of the wetland or in lower water levels that will "dry-land" nest sites.

D) Water level controls

Controls associated with irrigation and wetland management can have positive and negative effects on plant and invertebrate populations, depending on the timing and the amount of water affected (Kadlec 1962, Meeks 1969). Water level controls have been and are currently considered for some breeding lakes, and could affect nest site and food distribution and abundance.

E) Composition of the vertebrate community

Many lakes harbouring large Eared Grebe colonies are devoid of fish. Introduction of fish in these lakes for recreation purposes or fish farming would greatly affect food availability, as fish compete with grebes for

invertebrate preys (Ericksson 1979, Anderson 1981, Eadie and Keast 1982, Des Granges and Brodeur 1985).

3. Disturbance of incubating birds

Eared Grebes are very susceptible to disturbance during laying and incubation (Riske 1975). Recreational development along the shore and/or increased recreational activities on the lake may reduce reproductive success and even cause colony abandonment.

Overall, potential impacts of any of the above threats cannot be assessed at the present time due to lack of information on the distribution and breeding biology of Eared Grebes in British Columbia. In order to insure the protection of Eared Grebes, information is needed on a) location and number of breeding lakes, b) number of breeding pairs per lake, c) breeding success per breeding lake and d) influence of habitat quality and number of breeders on breeding success in British Columbia.

Few breeding records are available for the province (Munro 1941, 1942, McAllister 1958, British Columbia Nest Records Scheme). Detailed studies of breeding biology are available for only 2 lakes in British Columbia (McAllister 1958), and no information is available on young survival, fledging success, and how they are affected by habitat quality and breeding numbers. Published accounts and past breeding surveys are of little use in providing updated information on the B.C. population, for the following reasons: first, the data are spread over 50 years (mid-thirties to mid-eighties), with few observations on any given year. Second, different observers were involved, each surveying different areas. Surveying methods, equipment and the extent of the survey were rarely described. Third, surveys occurred from May to August, and could not be corrected for seasonal fluctuations in numbers, due to the lack of information on seasonal fluctuations in adult abundance. Last,

age-specific young survivorship and fledging success per pair has never been studied in North America, making it impossible to assess the number of breeding pairs from young counts. The extent of the variations in breeding numbers throughout the breeding season has not been documented, and we do not know what percentage of adults seen on the breeding grounds are actual breeders.

In summary, even though some information is available on distribution and biology of Eared Grebes in British Columbia, the usefulness of this data is limited because of lack of knowledge of general breeding biology and of difficulties in comparing results from different surveys.

To alleviate this lack of information, a study was initiated in 1985 with intentions to provide more precise information on the breeding biology of Eared Grebes in British Columbia (migrations, dates of clutch initiation, clutch size, nesting synchrony, breeding success and habitat description) and to relate that information to colony size and breeding success. The results of that study will be included in a M.Sc. thesis at the University of British Columbia, Vancouver, B.C. (Breault, in preparation).

A second aspect of the project was to provide updated information on the distribution and abundance of Eared Grebes in British Columbia. This report will be mostly concerned with that issue. Our analysis is based on historic records and results from 1985 and 1986 surveys of breeding lakes.

METHODS

1. Historic records

Data on historic distribution and size of Eared Grebe colonies in British Columbia were obtained from: 1) the B.C. Nest Records Scheme, available at the Royal British Columbia Museum in Victoria, 2) university graduate theses, 3) published literature, 4) Canadian Wildlife Service files, 5) Ducks Unlimited files, and 6) British Columbia Ministry of Environment files.

In addition, a survey form was distributed in 1986 along with the newsletter of the B.C. Federation of Naturalists and the Williams Lake Naturalist Club, to solicit further information on past and present breeding records. No new breeding lakes were located from those sources.

Only information on lakes with confirmed breeding records (nests with eggs, eggshells or presence of unfledged young) are included in this report. Empty nesting platforms or presence of adults or fledged young was not considered sufficient evidence of breeding attempt.

For compilation purposes, 4 areas suitable to nesting were recognized for British Columbia: Central Interior, Southern Interior, Northern Okanagan/Kamloops and the Peace River Region (Fig. 1). No field surveys were conducted in the Kootenays even though there were some historic records for this area. Breeding records will be reported separately for each region.

2. New surveys

Breeding surveys were conducted in the four areas of British Columbia mentioned above to locate breeding lakes (Fig. 2). Those 4 areas were selected because they include the most productive wetlands in the province.

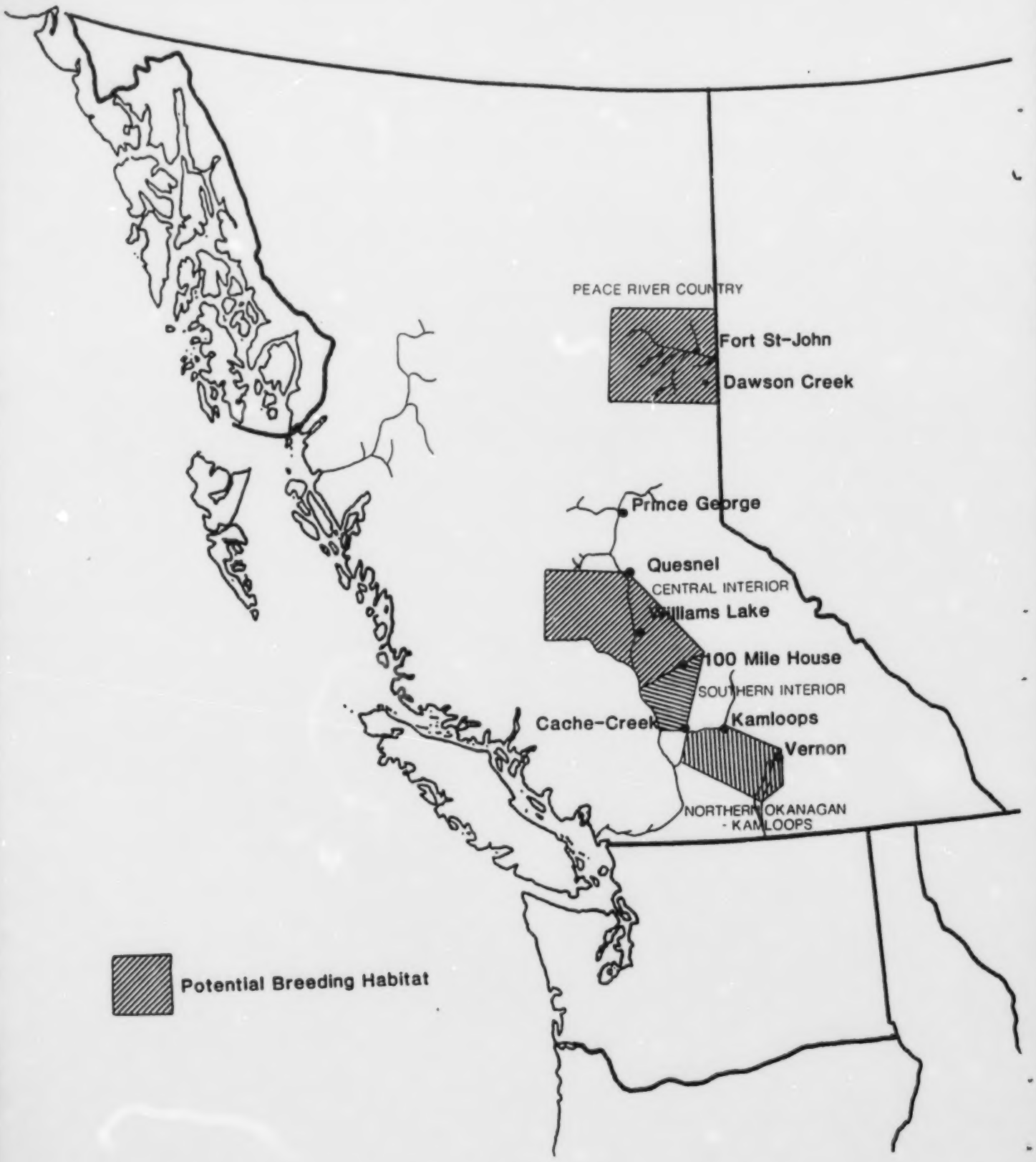

Figure 1. Zones with potential breeding habitat for Eared Grebes.

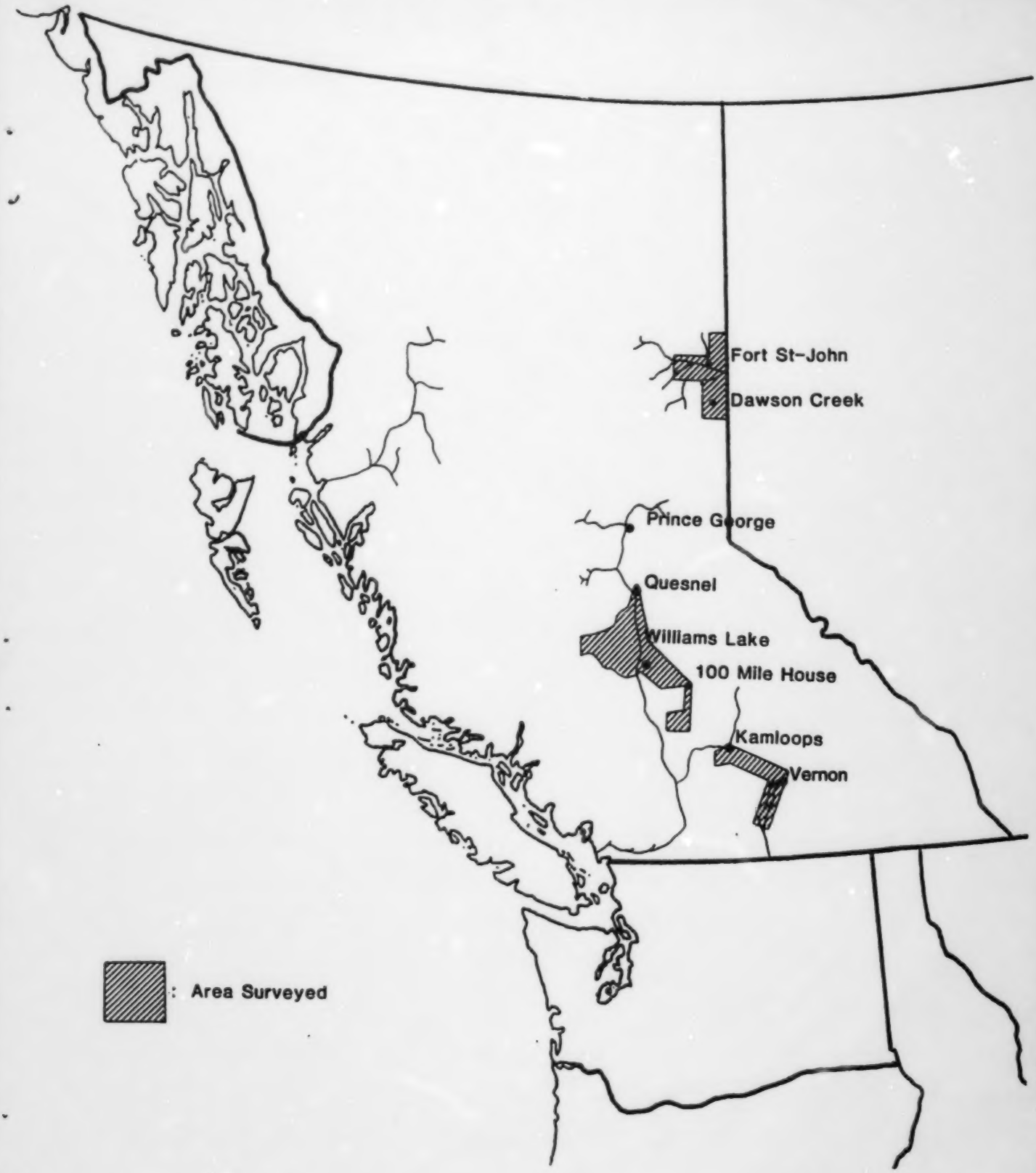

Figure 2. Area surveyed in 1985 and 1986 to locate Eared Grebe colonies.

The Interior was divided into Central and Southern sections to account for a lower surveying effort in the Southern section.

Survey methods were improved to eliminate or evaluate biases previously mentioned. Observer variability was eliminated by having only 1 observer conducting all surveys. Surveys on 419 lakes were conducted from May to August 1985 and 1986 in the 4 regions (see Table 1 for surveying effort per region). Breeding lakes of known locations were visited again when they were easily accessible. Other lakes were also surveyed for potential breeding colonies. Potential candidates were selected on 1:50,000 topographical maps based on the following criteria: a) being accessible by road, b) being located in open habitat (prairie or parkland), c) having part of their shoreline devoid of forest and d) showing signs of marshy areas (or presence of emergent vegetation). The rationale for those criteria was that all known breeding lakes in the Central Interior met conditions b), c) and d). Condition a) was added in order to increase the number of lakes that could be surveyed in the limited time available. Mercator locations of all 419 lakes surveyed in 1985 and 1986 are presented on a regional basis in Appendix 8. Readings were made on 1:50,000 topographic maps.

Regional breeding populations could be estimated by comparing the ratio of suitable lakes used/unused for breeding to the overall number of breeding lakes meeting the conditions outlined above. Because the latter information is not currently available, assessment of regional populations will not be presented in this report.

The following information was recorded during each breeding survey: number of adults, number and age of young, and number of nests and eggs observed. The type and frequency of observations on each lake varied with lake accessibility and time of year of the survey. Survey results are presented in Appendices 2 to 7.

Table 1. 1985-1986 surveying effort and distribution of historic records of Eared Grebe colonies in British Columbia.

Region	Historic records		1985 and 1986 surveys					
			Lakes previously surveyed		Lakes not previously surveyed		Total	
	No. of breeding lakes	No. lakes locatable	No. visited	No. active	No. visited	No. active	No. visited	No. active
Northern Okanagan/Kamloops	17	8	2	2	66	4	68	6
Southern Interior	5	4	3	3	34	4	37	7
Peace River	12	11	9	7	25	2	34	9
Central Interior	28	25	20	7	260	17	280	24
						Total	419	46

3. Survey techniques

A) Counts of adults and young

Counts of adults and young were made from vantage points along the shore with binoculars and/or spotting scopes. On less than 25 ha lakes, counts were repeated at least twice and the highest count was recorded. On larger lakes, birds were counted only once, slowly enough to take into account diving and resurfacing birds. Age and number of young per brood were recorded on a tape recorder in order to continuously observe broods. Aging was done by using Gollop and Marshall's system of plumage development in waterfowl (Gollop and Marshall 1953, Bellrose 1978). No efforts were made to flush birds from emergent vegetation in order to avoid disturbance of incubating birds. Therefore, a variable number of birds may have been missed on each survey. This proportion varied throughout the breeding season as the number of incubating birds changed. Adults were recorded as either single or paired. Early in the season, large numbers of non-foraging single individuals were taken as an indication that incubation had started and signalled the start of nest searches. Adult behaviour also affected counts, as actively feeding birds were sometimes missed. Feeding frequency was subjectively assessed at survey time. When high feeding frequencies occurred, several surveys were conducted and the highest count was used. Breeding adults are not known to move to and feed on lakes other than the one on which they breed (Palmer 1962) so there is little chance of overestimates due to movements between lakes.

For analysis, young were classified as less than 2 weeks old and over 2 weeks old. This division is based on the behaviour and conspicuousness of the young. Young less than 2 weeks old spend most of their time under their parents' wings and were thus difficult to count. Older chicks are not transported on the back of the parents and were therefore easier to count.

B) Count of nests

Nests were counted by wading through the emergent vegetation of the lake. Active nests (with eggs or signs of hatching such as the presence of vascularized membranes and small pieces of shell) were distinguished from empty platforms (no signs of eggs or hatching). In areas of high density small pieces of white rope were added to counted nests and platforms to avoid double counting. The number of eggs in active nests was recorded for each visit.

Because all pairs do not initiate laying at the same time and because the area suitable to nest building could not always be totally checked, counts represent minimum estimates.

C) Estimates of breeding abundance

For any given lake, a maximum of 3 estimates of the number of breeding pairs per lake could be derived (from adult counts, nest counts and young counts).

i - From adult counts

This estimate was obtained by dividing by 2 the maximum number of adults observed during the April-August period. Incubating or feeding adults could have been missed, biasing the estimate downwards. However, non-breeders could have been included in the counts, biasing the estimate upwards.

ii - From nest counts

When several nest counts were available on a given lake, the highest number of active nests was assumed to be equal to a minimum number of breeding pairs. This is a minimum estimate because egg-laying is rarely fully synchronized and is affected by nest depredation. Counts of empty platforms (occurring before laying was initiated, after hatching or after nest

depredation) were treated as active nest counts, because there does not seem to be any simple relationship between number of platforms initiated and number of active nests present on the breeding lake: some pairs build platforms without laying in them while others can build many nests, especially after depredation on the initial one. It is then impossible to infer the fate of empty platforms without some evidence of hatching. For this report, we assumed that:

1 - when no active nest counts were available, platform counts were equivalent to active nest counts;

2 - the maximum number of active nests was equal to the minimum number of breeding pairs on the lake;

3 - no evidence is currently available for British Columbia that Eared Grebes can raise a second brood.

Even though empty platforms were treated as active nests in the analyses, they are presented separately in the tables because of the possible biases associated with platform counts. Lakes where platform counts were used can then clearly be identified, and if a relation is ever found between platform and nest counts, it will be possible to reinterpret this data.

iii - From young counts

The number of pairs on a lake can be determined from young counts if a) precise counts are available, b) an accurate aging method is available, and c) if we know young survival rates for each age-class. For Eared Grebes, precise young counts are difficult to make, for two reasons. First, right after hatching, young chicks spend most of their time under the wings of their parents, making their detection difficult. Second, aging is imprecise due to asynchronous hatching of young and preferential feeding of certain young.

Young of the same age could have different growth rates and thus be of different sizes.

Age specific survival rates were obtained from a detailed study on 174 nests surveyed in 1985 and 1986 at Riske Creek, B.C. (Breault, unpubl.). Counting and aging problems were minimized by dividing the time from hatching to fleding into 3 periods, each period having distinct visibility and growth rates. The first period went from hatching to 2 weeks of age. Young were poorly visible up to the age of 2 weeks, after which time they left the cover of their parents' wings. The second period went from 2 weeks old to 1 month old. Young were not carried by their parents, even though the latter still fed them. Past the age of 1 month, young were rarely accompanied by adults and were easily detectable when not feeding (Breault, unpubl.).

Survival rate from hatching to 2 weeks old was derived by comparing the number of eggs hatched to the number of young that survived to at least 2 weeks of age. Because of lack of further information, clutch size (3.48 eggs/nest; McAllister 1958) was assumed to represent the number of young hatched. Survival rate for that period was 1.13 young/pair, or 32.4% of the hatched young (n=417 nests; Breault; unpubl.). This is likely an underestimate because:

1 - young counts are underestimates;

2 - the number of young hatched is assumed to be equal to clutch size but hatchability is usually less than 100%;

3 - survival to 2 weeks or more takes into account mortality occurring after 2 weeks of age (due to how the data was collected, this bias could not be avoided)

4 - all unfledged young less than 1 month old surveyed late in August were assumed not to survive to fledging.

Survival after 2 weeks was derived in a similar fashion. Fledging rates could not be directly obtained because young disperse to various lakes after fledging, and because fledging can be highly asynchronous within and among colonies (Breault, unpubl.). The survival rate up to at least 4 weeks of age was 0.95 young/pair (Breault, unpubl.). Low number of surveys past that age and movements between lakes did not allow for actual estimates of fledging rate.

Overall, at least 32.4% of the young survived the first 2 weeks. For the next 2-week period, survival rose to 84%. Considering this increased survival with age and the short interval between 4 weeks old and fledging time, we assumed that survival rate for 2 weeks to 4 weeks is the same as survival rate from 2 weeks to fledging (84%).

From those survival rates, an overall estimate of the number of breeding pairs on each lake was derived by comparing the overall number of young hatched with average clutch size. The number of young hatched was derived from age-specific survival rates. For each age-class, we used the maximum number of young seen times the ratio of young that did not survive to that age (the inverse of age-specific survival). Similar calculations were done for older age-classes, and we took into account that survival is cumulative. By adding up data for each age-class, we obtained the overall number of young hatched on the lake. Calculations were as follows:

$$B.P. = [(Y_1/S_1)+(Y_2/S_1S_2)]/C.S.$$

where

B.P. = number of breeding pairs

Y_1 = number of young less than 2 weeks old

Y_2 = number of young more than 2 weeks old

S_1 = % young survival from 0 to 2 weeks old (=0.32)

S_2 = % young survival from 2 weeks old to fledging (=0.84)

C.S. = clutch size (3.48 eggs/nest)

For example, if Y_1=10 young less than 2 weeks old and Y_2=20 young more than 2 weeks old, the number of breeding pairs would be obtained with the following calculations:

B.P. = [(10/0.32)+(20/0.32x0.84)]/3.48

B.P. = [(31.25)+(74.4)]/3.48

B.P. = 30.36 pairs, rounded down to 30 pairs

There would then be 30 pairs nesting on that lake. Young counts and young survival being both underestimates, we assumed that their biases cancelled one another out.

iv - Overall Breeding Abundance Estimate

For some breeding lakes, 3 indices of breeding abundance could be derived from the adult, nest and young counts (Tables 3, 4, 6, 7, 9, 10, 12 and 13). The first two were based on definite breeding records (presence of unfledged young or nests with eggs). If complete nest surveys were available, nest counts were used to estimate overall number of breeding pairs. When no or incomplete data on nest counts were available, we used young counts to get the overall estimate. The last index was based on adult abundance and was not necessarily indicative of breeding abundance. It was obtained from the estimate based on the maximum adult count.

Estimates of the overall number of breeding pairs per region (Tables 5, 8, 11, 14) were derived by adding up minimum and maximum estimates for each lake. For each lake, only the breeding records for the 2 most recent years were considered. Lowest and highest estimates were determined from Tables 1, 3, 4, 6, 7, 9, 10, 12 and 13). Both estimates were used to illustrate fluctuations in abundance, either representing fluctuations in breeding populations or differences in surveying effort. For cases where only a few

surveys were conducted late in the year, an arbitrary correction factor was used.

Adult-based indices are of limited use because of the potential presence of either migrants, non-breeders or visitors from other breeding lakes. They are however, presented to complement limited nest and young count data sets. Adult-based indices should be viewed as a rough assessment of the breeding population when no other good data set is available.

RESULTS

1. Regional distribution

a) Northern Okanagan/Kamloops

Prior to 1985, 17 breeding lakes had been identified in the area (Table 2). During the 1985-1986 surveys, 2 of those lakes were visited again, and 4 new breeding lakes were found (Tables 3 and 4). Overall, only Stump Lake was used by a significant number of pairs (estimate of 74-100 pairs).

If we assume that breeding records from the past represent current breeding numbers, the known breeding population ranges in size from 109 to 280 pairs (roughly 6% of the provincial population) (Table 5). This is probably related to the low quantity of suitable breeding habitat.

b) Southern Interior

Historically, 5 breeding lakes were known in the area (Table 6), 3 of which were visited again in 1985 and 1986. Little changes were observed in breeding numbers. Only Meadow Lake was known to be used by more than 50 breeding pairs (Table 6), and the population remained the same or possibly increased (Tables 7 and 8). For that lake, adult and nest counts indicated the presence of both breeders and non-breeders during the breeding season. Nesting habitat is restricted to the northeast shore, but adult counts account

Table 2. Historic records of Eared Grebe colonies in the Northern Okanagan/Kamloops area.

Lake/Area	Location (UTM coordinates or topo map no.)	Survey Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate	Source	Status in the 1985-1986 survey[1]
Alki	82 E/14	1930	30						Cannings et al.	K
Campbell/Lew	10.7060-56040	1983	10		6		some		BCNRS	K
		1938		44					BCNRS	
Deer	82 K/9	1977					3		BCNRS	U
Douglas	10.6990-55600	1939	2				some		BCNRS	K
Duck	82F1 or F2	1982	20						BCNRS	U
Hamilton Corral	unknown	1939		2			2		Munro 1942	U
Hwy. 95, Golden	82 NE	1977			3				BCNRS	U
		1979			2				BCNRS	
		1984	1						BCNRS	
Kamloops (5 mi.so.)	92 I9	1973			12				BCNRS	E
McKay's	82 E/14	1933		2					Munro 1941	U
		1938			8-9				Munro 1941	
Munson	82 E/14	1927			1				Munro 1941	U
		1932		30					Munro 1941	
		1933		2					Munro 1941	
		1935		2					Munro 1941	
		1936		8					Munro 1941	
		1937			1				BCNRS	
		1938			8-9				BCNRS	
		1950			2				BCNRS	
Oyoyoos	82 E3	1928			1				BCNRS	U
Round	11.3345-55885	1945			some				BCNRS	I
Separation North	10.6918-56070	1935		2			2		BCNRS	A
Spectacle (spotted)	11.3128-54390	1936			1				BCNRS	K
Swan	11.3400-55770	1932		6			3		Munro 1941	I
		1933		8			8		Munro 1941	
		1934					8		Munro 1941	
		1940		6			2		Munro 1941	

Table 2. Historic records of Eared Grebe colonies in the Northern Okanagan/Kamloops area. (cont'd)

Lake/Area	Location (UTM coordinates or topo map no.)	Survey						Source	Status in the 1985-1986 survey[1]
		Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate		
Swan (cont'd)		1948			1				BCNRS	
		1949			21				BCNRS	
		1950	5						BCNRS	
White	82 E/15	1972			1+				BCNRS	U
	82 E/15	1984	1+						BCNRS	U

1. List of abbreviations is given in Appendix 1.

Table 3. Size of Eared Grebe colonies in 1985 for the Northern Okanagan/Kamloops area (1 survey done on 10 July 1985).

Lake	No. of adults	Max. no. of flightless young <2 weeks old	>2 weeks old	No. of nests	No. of platforms	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Separation South	24	0	0	-	-	-	0	12
Separation North	4	13	6	-	-	-	18	
Total							18	30

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

Table 4. Size of Eared Grebe colonies in 1986 for the Northern Okanagan/Kamloops area (1 survey conducted on 16 and 17 July 1986).

Lake	No. of adults	Max. no. of flightless young <2 weeks old	>2 weeks old	No. of nests	No. of platforms	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Separation South	47	4	42	-	-	-	48	
Separation North	9	0	0	-	-	-	0	4
Stump	67	0	0	61+	13+	74+		
Rawlings	49	1	3	-	-	-	4	24
Kamloops A (Mitchell)	7	3	6	-	-	-	9	
Tunkwa 3	2	0	0	-	-	-	0	1
Total						135		160

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

Table 5. Estimated number of Eared Grebe pairs in the Northern Okanagan/Kamloops area.

Lake	Location (mercator coordinates)	Estimate*
Separation South	10.6918-56063	0-48
Separation North	10.6917-56072	0-18
Stump	10.6845-55786	74-(100)
Rawling	11.3663-55705	4-24
Kamloops A (Mitchell)	10.6934-56113	9-(10)
Munson	unknown	2-9
McKay's	unknown	8-9
Lew (Campbell)	10.7060-56040	6-22
Hamilton Corrals	unknown	1
Douglas	10.6990-55600	2
Round	11.3345-55885	2-(10)
Golden	unknown	1-2
Deer	unknown	1
Duck	unknown	0-20
Osoyoos	unknown	1
Spectacled	11.3128-54390	1
White	unknown	1
Tunkwa	10.6528-56067	0-1
Total		109-280

* Presents the minimum and maximum estimates obtained from the 2 most recent years of surveys (see Tables 2,3,4). Some maximum values are personal inferences and are presented in parentheses.

Table 6. Historic records of Eared Grebe colonies in the Southern Interior area.

Lake/Area	Location (UTM coordinates or topo map no.)	Survey						Source	Status in the 1985-1986 survey[1]
		Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate		
Alkali	10.5500-57365	1948			some				BCNRS	K
		1970					2		BCNRS	
Green Lake Rd.	92 P/6	1961			15				BCNRS	E
		1978	7			6			BCNRS	
Meadow	10.5860-56910	1978		158			109		BCNRS	A
43 Mile	92 P/4	1978	5				some		BCNRS	E
70 Mile (3 mi.east)	92 P/6	1980			5	4			BCNRS	E

1. List of abbreviations is given in Appendix 1.

Table 7. Size of Eared Grebe colonies in 1985 for the Southern Interior area (n=numbers of surveys done between 29 April and 11 July 1985).

Lake	No. of adults (n)	Max. no. of flightless young <2 weeks old n=1	>2 weeks old n=1	No. of nests n=1	No. of platforms n=1	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Meadow Lake	329(3)	0	0	40+	25+	65+		164
Green Lake A	5(2)	0	0	4+	-	4+		
Green Lake B	29(3)	2	12	4+	15+	19+		
Green Lake C	5(1)	0	0	-	-	-	0	2
Little White Lake	-	-	-	-	-	-	-	-
Soda Lakes I&J	-	-	-	-	-	-	-	-
4403 Lakes	67(2)	0	0	46+		46+		
Total						134		136

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

Table 8. Size of Eared Grebe colonies in 1986 for the Southern Interior area (n=numbers of surveys done between 3 May and 24 July 1986).

Lake	No. of adults (n)	Max.no. of flightless young <2 weeks old n=1	>2 weeks old	No. of nests n=1	No. of platforms n=1	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Meadow Lake	133(2)	4	0	37+		37+		66+
Green Lake A	4(2)	0	0	1+	2+	3+		
Green Lake B	5(2)	0	9	1+	5+		9	
Green Lake C	0(1)	0	0	-	-	-	0	0
Little White Lake	451(1)	470	88	-	-	-	590	
4403 Lakes	42(2)	16	4	6+	30+	36+		
Total						675		704

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

Table 9. Estimated number of Eared Grebe pairs in the Southern Interior area.

Lake	Location (mercator coordinates)	Estimate*
Meadow Lake	10.5860-56910	37-164
Green Lake A	10.6147-56858	3-4
Green Lake B	10.6150-56853	9-19
Green Lake C	10.6151-56856	0-2
Little White Lake	10.5915-56815	590-(700)
4403 lakes	10.5890-56906	36-46
43 miles	unknown	1-5
Total		676-940

* Presents the minimum and maximum estimates obtained from the 2 most recent years of surveys (see Tables 6,7,8). Some maximum values are personal inferences and are presented in parentheses.

for more than the number of pairs expected from nest counts. Adults were found in large groups away from the shore, which is contrary to usual breeding behaviour.

Four new breeding lakes were located in 1985 and 1986 (Tables 7 and 8). Little White Lake was the one used by the most pairs with an estimated 590 pairs in 1986. A higher population is however suspected, for the following reasons. First, the estimate was derived from an 18 July 1986 young count. Young counts, especially on large lakes, tend to underestimate the true number of young because of problems with visibility, feeding behaviour, high young densities, etc. Also, considering that 1) no nest search was conducted and 2) the degree of synchronization among nests could not be assessed, some birds could have been incubating and not counted. Furthermore, surveying took 4 hours, or twice as long as another lake of similar size with young of the same age known to be used by more than 400 pairs. Finally, a survey conducted by Ducks Unlimited (Canada) on 15 June 1986 reported 1,600 adult Eared Grebes on the lake.

Overall, the area includes roughly 20-38% of the known provincial population (Table 9), concentrated mostly on Little White Lake and Meadow Lake. Productive wetlands with good nesting cover are abundant in the area, but only a small number of them could be surveyed with the available resources. Further surveys are recommended for the area.

c) Peace River Region

At one time, this region included the 2 largest breeding lakes in British Columbia: Cecil Lake, with more than 1,000 pairs (1978 and 1981 estimates) and Boundary Lake, with an estimated 600-800 pairs (1978) (Table 10). Overall, 12 lakes in the area are known to have supported Eared Grebes. Except for Boudreau "B", all were visited again in 1985 and 1986. Most were still

Table 10. Historic records of Eared Grebe colonies in the Peace River area.

Lake/Area	Location (UTM coordinates or topo map no.)	Survey Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate	Source	Status in the 1985-1986 survey[1]
Boudreau A	10.6030-62250	1981		140		A	some		BCNRS	A
		1981	20+						DUC	
Boudreau B	10.5970-62255	1981	20+						DUC	K
Boundary	10.6850-62480	1978			91	A		600-800P	BCNRS	A
		1980						100P	BCNRS	
		1981						75+P	BCNRS	
		1982						400+P	BCNRS	
		1983		±150	119				DUC	
		1984		200+			200+		BCNRS	
		1985						500-1000P	DUC	
		1986		590					DUC	
Cecil	10.6490-62450	1962			132	A		2500N	BCNRS	A
		1973	240				240+		BCNRS	
		1978		2862	284		2900	1000P	BCNRS	
		1980	178					400P	BCNRS	
		1981		150-200			100+		BCNRS	
		1982		6-7	4		some	1000+P	BCNRS	
		1983	46	113			52+		BCNRS	
		1984					some	1000P	BCNRS	
		1985		430					DUC	
Charlie	10.6260-62400	1975		1		A	12		BCNRS	I
Cutbank	10.6840-61340	1985	60-100			A			DUC	A
German	10.6820-62520	1984	2						DUC	I
Huhn's Slough	10.6396-62485	1976			16			35P	BCNRS	I
		1977			1				BCNRS	
		1978			2				BCNRS	
		1985	1						DUC	
		1962			61				BCNRS	
McQueens Slough	10.6782-61860	1980	many						DUC	A
		1987		206	73	5			BCNRS	
Scott	10.6310-61965	1982		4					DUC	K

Table 10. Historic records of Eared Grebe colonies in the Peace River area. (cont'd)

Lake/Area	Location (UTM coordinates or topo map no.)	Survey						Source	Status in the 1985-1986 survey[1]
		Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate	
Savage Lagoon	Ft.St.John unknown	1982		43			43+		BCNRS	A
		1983			2			11N	BCNRS	
		1985	4		7			20P	BCNRS	
Sloane's Slough	10.6390-61869	1985	1						DUC	A

1 List of abbreviations is given in Appendix 1.

Table 11. Size of Eared Grebe colonies in 1985 for the Peace River area (based on 1 survey conducted between 13 and 15 August 1985).

Lake	No. of adults	Max.no of flightless young <2 weeks old	Max.no of flightless young >2 weeks old	No. of nests	No. of platforms n=1	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Fort St. John Potholes	4	0	31	3+	0	-	33	
Boundary	4	0	78	-	-	-	83	
Boudreau A	29	4	170	-	-	-	185	
Cutbank	0	0	0	-	-	-	0	
German	1	0	11	-	-	-	11	
Cecil	61	1	58	1+	13+	-	62	
"Bob Emery"	5	1	30	-	-	-	33	
Whispering Pine	3	0	23	-	-	-	24	
McQueen's Slough	8	0	22	-	-	-	23	
Sloane's Slough	0	0	0	-	-	-	0	
Total					454		-	

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

Table 12. Size of Eared Grebe colonies in 1986 for the Peace River area (based on 1 survey conducted between 25 and 29 July 1986).

Lake	No. of adults	Max.no. of flightless young <2 weeks old	>2 weeks old	No. of nests	No. of platforms n=1	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
Fort St. John Potholes	3	0	0	-	-	-	0	1
Boundary	33	2	193	-	-	-	208	295[4]
Boudreau A	339	11	103	15+	3+	-	120	169
Cutbank	55	21	2	5+	5+	-	20	27
German	14	0	0	-	-	-	0	7
Cecil	534	230	167	99+	205+	-	385	
"Bob Emery"	-	-	-	-	-	-	-	-
Whispering Pine	0	0	0	-	-	-	0	
McQueen's Slough	59	3	57	12+	0	-	63	
Sloane's Slough	0	0	7	-	-	-	7	
Total						803		954

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).

2 Y = Estimate based on young counts (only presented when P was not calculated).

3 A = Estimate based on adult counts (only presented if greater than P or Y).

4 Ducks Unlimited survey.

Table 13. Estimated number of Eared Grebe pairs in the Peace River area.

Lake	Location (mercator coordinates)	Estimate*
Fort St. John Potholes	10.6377-62383	0-33
Boundary	10.6850-62480	83-295
Boudreau A	10.6030-62250	120-(700)
Cutbank	10.6840-61340	0-(50)
German	10.6820-62520	0-11
Cecil	10.6490-62450	62-(500)
"Bob Emery"	10.6302-62655	33
Whispering Pine	10.6240-62725	0-24
McQueen's slough	10.6775-61872	23-63
Sloane's slough	10.6388-61868	0-7
Boudreau B	10.5970-62255	20-(50)
Charlie	10.6260-62400	1-5
Huhn's slough	10.6393-62465	0-2
Scott	10.6310-61965	0-2
Total		342-1775

* Presents the minimum and maximum estimates obtained from the 2 most recent years of surveys (see Tables 10,11,12). Some maximum values are personal inferences and are presented in parentheses.

actively used, even though Eared Grebes were less abundant overall (Tables 11 and 12). The data collected in 1985 and 1986 cannot account for the historic high populations once observed on Cecil Lake and Boundary Lake. This could be due in part to late surveying both in 1985 and 1986 (respectively surveyed on 15 August and 26-27 July), or may reflect actual changes. Earlier counts would be needed to confirm the possible decline.

The most interesting lake of this region is Boudreau Lake A. The lake is large (336 ha), not easily accessible, and used by a fair number of Eared Grebes (339 adults on 28 July 1985). It is covered with scattered patches of Scirpus sp. Counting is difficult due to the size of the lake and the presence of emergent vegetation. Searches for nests would be time-consuming (minimum 2-3 days). Numbers presented here are likely underestimates.

The Peace River Region accounts for 20-40% of all known breeding Eared Grebes in B.C., concentrated on 3 major breeding lakes: Cecil, Boundary and Boudreau Lakes (Table 13). With the exception of the small set of lakes surrounding Boudreau Lake, there is very little potential for undiscovered breeding lakes in the area. Wetland numbers are low and most of them are currently surveyed by Ducks Unlimited (Canada).

d) Central Interior

More than half the breeding lakes known in B.C. are located in this region (Table 14). The largest populations were found on Westwick Lake (419 nests and 50 platforms in 1978), Rock Lake (160 nests in 1978), and Sorenson Lake (50+ pairs in 1949).

Surveys conducted in 1985 and 1986 covered 20 of the 28 lakes of known locations identified from historic records. Some changes in colony size were observed for some lakes (Tables 15 and 16). For example, Eared Grebes were still breeding on Westwick and Rock lakes, but the numbers were down compared

Table 14. Historic records of Eared Grebe colonies in the Central Interior area.

Lake/Area	Location (UTM coordinates or topo map no.)	Survey						Source	Status in the 1985-1986 survey[1]
		Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate		
Becher's Prairie	920/16	1970	5		34				BCNRS	U
Boitanio	10.5600-57550	1942		2					Munro 1942	I
Bonds Lake area	unknown	1973		5			1		BCNRS	U
Cummings	10.5720-57709	1938		6			6		Munro 1941	I
		1939		5			5		Munro 1941	
		1940		1			1		Munro 1941	
		1942		6					Munro 1941	
		1943			1		2		BCNRS	
Dry	10.4995-57450	1980			36+			50+N	BCNRS	A
Duncan	93 A4	1953			3+				BCNRS	U
		1960			2+				BCNRS	
Green	unknown	1978		158			109		BCNRS	U
Rock	10.5400-57580	1978			160	5			BCNRS	A
		1980			117	29			BCNRS	
Rush	unknown	1941			10	10		20P	BCNRS	U
		1942		6					Munro 1942	
		1958			5				BCNRS	
		1959			1				BCNRS	
Separation	10.5344-57577	1978	1		22				BCNRS	A
Soda	10.6140-57374	1983	1	3					Gauthier, unpubl.	I
		1984		1					Gauthier, unpubl.	
Soda A	10.614-57357	1983	1						Gauthier, unpubl.	I
Soda G	10.6148-57380	1983		2			5		Gauthier, unpubl.	I
		1984		3					Gauthier, unpubl.	
Soda I	10.6130-58369	1983					2		Gauthier, unpubl.	A
Soda J	unknown	1984					2		Gauthier, unpubl.	E

Table 14. Historic records of Eared Grebe colonies in the Central Interior area. (cont'd)

Lake/Area	Location (UTM coordinates or topo map no.)	Survey Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate	Source	Status in the 1985-1986 survey[1]
Sorenson	10.5567-57615	1931						0	Munro 1941	A
		1938			20				BCNRS	
		1938					90+		Munro 1941	
		1941		80			100	40+P	Munro 1941	
		1941		25+					Munro 1941	
		1949	50+				some		BCNRS	
		1955			37				McAllister 1956	
		1956			22				McAllister 1956	
Stum	10.4990-57900	1974			2				BCNRS	K
Tachick	10.4200-59780	1945			7				BCNRS	K
		1946		4			3		BCNRS	
Watson	10.6150-57290	1939					1		BNCRS	I
		1959			3				BCNRS	
Westwick	10.5580-57600	1937		45					Munro 1941	A
		1937	1		1				BCNRS	
		1938		120			60+		Munro 1941	
		1941		228	1	several			Munro 1941	
		1942		160+	17	6			Munro 1941	
		1942	40+		17	6			BCNRS	
		1948			2			100P	BCNRS	
		1949			40				BCNRS	
		1955			113				McAllister 1956	
		1956			121				McAllister 1956	
		1970			1				BCNRS	
		1978			419	50			BCNRS	
100 Mile House	92P/11	1972			11				BCNRS	E
103 Mile House	10.6180-57270	1936		2			3		Munro 1941	I
		1937		some			some	20	Munro 1941	
		1938		10					Munro 1941	
		1941		2					Munro 1941	
		1942						none	Munro 1942	

1 List of abbreviations is given in Appendix 1.

Table 14. Historic records of Eared Grebe colonies in the Central Interior area. (cont'd)

Lake/Area	Location (UTM coordinates or topo map no.)	Survey						Source	Status in the 1985-1986 survey[1]
		Year	Pairs	Adults	Nests	Platforms	Young	Overall estimate		
105 Mile House	10.6155-57304	1937					4		Munro 1941	I
		1939		7					Munro 1941	
		1941		2					Munro 1941	
		1942						none	Munro 1942	
108 Mile House	10.6130-57335	1936	1				3		Munro 1941	I
		1942						none	Munro 1942	
148 Mile House	93 A/4	1980			1				BCNRS	E
		1983					some		BCNRS	
149 Mile House	93 A/4	1939		4			1		Munro 1941	E
		1941		6					Munro 1941	
		1942		6					Munro 1942	
		1970		27	11				BCNRS	
		1977	6		5				BCNRS	
150 Mile House	93 A/4	1977	8		7				BCNRS	E
		1980			13				BCNRS	
42	10.5332-57643	1978	4				10		BCNRS	A

1 List of abbreviations is given in Appendix 1.

Table 15. Size of Eared Grebe colonies in 1985 for the Central Interior area (n=number of surveys done between 30 April and 18 August 1985).

Lake	No. of adults (n)	Max.no. of flightless young <2 weeks old (n)[4]		>2 weeks old	No. of nests (n)	No. of platforms (n)	Estimated No. of breeding pairs P[1]	Y[2]	A[3]
6	139(34)	45	(10)	3	81(12)		81		
11	53(36)	4	(11)	46	33(16)		33		
12	10(33)	0	(1)	0	2(7)		2		5
16	51(38)	13	(9)	1	11(11)		11		25
24	30(39)	11	(12)	21	14(11)		14		15
26	12(36)	0	(1)	0	0(4)		0		6
28	5(6)	2	(5)	2	1(1)		1		
40[3]	40(39)	0	(1)	0	0(8)		0		
S of 40	31(39)	1	(12)	14	14(12)		14		15
SS of 40	26(42)	0	(6)	5	8(10)		8		13
42	42(39)	0	(1)	0	17(9)		17		21
53	10(37)	0	(1)	0	3(14)		3		5
Westwick	446(10)	8	(3)	221	80+(2)		-	243	
Sorenson	38(10)	6	(1)	3	-		-	8	19
Coyote	14(8)	1	(2)	0	8(1)		8		
McMurray	806(11)	0	(3)	335	343+(1)	15+(1)	358+		403
Elkhorn	364(3)	78	(1)	18	262+(1)		262+		
8432 North	112(4)	0	(1)	25	72+(1)	14+(1)	86+		
8432 South[3]	58(4)	0	(1)	0	0(1)		-	0	29
Upper Dry	115(3)	0	(2)	17	3+(1)		-	18	57
Lower Dry	57(3)	0	(3)	13	35+(1)		35+		
Dry 3	-	-	-	-	-		-	-	-
Jamieson Meadow	1(1)	0	(1)	6	-		-	6	
Golden Pond	-	-	-	-	-		-	-	-
Total							1208		1368

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).
2 Y = Estimate based on young counts (only presented when P was not calculated).
3 A = Estimate based on adult counts (only presented if greater than P or Y).
4 No. of surveys after young should have hatched.

Table 16. Size of Eared Grebe colonies in 1986 for Central Interior area (n=number of surveys done between 4 May and 28 August 1986).

Lake	No. of adults (n)	Max.no. of flightless young			No. of nests (n)	No. of platforms	Estimated No. of breeding pairs		
		0-2 weeks old	(n)[4]	>2 weeks old			P[1]	Y[2]	A[3]
6	165(32)	0	(5)	0	37(6)		37		82
11	28(32)	3	(3)	40	21(10)		21		
12	48(36)	0	(5)	9	19(13)		19		24
16	42(34)	8	(14)	0	28(11)		28		
24	14(35)	0	(5)	0	1(7)		1		7
26	23(35)	0	(5)	14	7(7)		7		11
28	6(31)	0	(5)	0	0(1)		-	0	3
40[3]	32(31)	0	(5)	0	0(7)		-	0	0
S of 40	15(42)	0	(5)	0	5(7)		5		7
SS of 40	9(35)	0	(5)	0	0(9)			0	4
42	37(39)	14	(5)	27	17(8)		17		18
53	9(36)	1	(5)	9	4(7)		4		
Westwick	381(10)	106	(4)	127	206+(6)		206+		
Sorenson	28(8)	0	(4)	0	-	-	-	0	14
Coyote	18(4)	0	(1)	8	0(1)	6+(1)	-	8	9
McMurray	374(4)	239	(2)	126	0(2)	438+(2)	438+		
Elkhorn	119(1)	29	(1)	66	60(1)	0 (1)	-	96	
8432 North	15(2)	3	(1)	36	0(1)	21+(1)	-	41	
8432 South[3]	2(1)	0	(1)	0	-	-	-	0	1
Upper Dry	56(2)	0	(1)	0	-	-	-	0	28
Lower Dry	16(2)	0	(1)	0	-	-	-	0	8
Dry 3	5(1)	0	(1)	5	1+(1)	-	-	5	
Jamieson Meadow	6(3)	1	(1)	17	-	-	-	19	
Golden Pond	2(1)	1	(1)	2	-	-	-	3	
Soda I & J	7(1)	5	(1)	1	-	-	-	5	
Total							960		1082

1 P = Estimate based on nest and platform counts (only presented when complete counts were available).
2 Y = Estimate based on young counts (only presented when P was not calculated).
3 A = Estimate based on adult counts (only presented if greater than P or Y).
4 No. of surveys after young should have hatched.

Table 17. Estimated number of Eared Grebe pairs in the Central Interior area.

Lake	Location (mercator coordinates)	Estimate*
6 (Rock)	10.5400-57580	37-(82)
11	10.5387-57605	21-33
12	10.5390-57609	2-24
16(Separating)	10.5344-57588	11-28
24	10.5386-57616	1-15
26	10.5387-57619	0-11
28	10.5375-57615	0-3
S. of 40	10.5338-57639	5-15
SS. of 40	10.5337-57637	0-13
42	10.5332-57643	17-21
53	10.5380-57626	3-5
Westwick	10.5580-57600	206-243
Sorenson	10.5570-57610	0-19
Coyote	10.5445-57910	8-9
McMurray	10.5415-57877	358-(450)
Elkhorn	10.4874-57386	96-262
8432 North	10.4817-57767	41-86
Upper Dry	10.4995-57450	0-57
Lower Dry	10.5005-57445	0-35
Dry 3	10.4984-57452	0-5
Jamieson Meadow	10.5212-57353	6-19
Golden Pond	10.4887-57381	3
Soda I & J	10.6130-58369	5
Rush	10.7110-55710	1-5
5 mi East of 100 Mile	unknown	11
Stum	10.4990-57900	2
Tachick	10.4200-59780	2-7
Near Bonds	unknown	1-3
Duncan	unknown	2-3
Alkali	10.5500-57365	1-5
Total		634-1479

* Presents the minimum and maximum estimates obtained from the 2 most recent years of surveys (see Tables 14,15,16). Some maximum values are personal inferences and are presented in parentheses.

to 1978 levels: 206 pairs on Westwick in 1986 and 37-82 pairs on Rock Lake in 1986. Low numbers of Eared Grebes were found on Sorenson Lake in 1985 and 1986, probably because of low water levels caused by drainage for irrigation purposes.

Seventeen new breeding lakes were identified in the area, the most important being McMurray Lakes, used by more than 400 pairs both in 1985 and 1986. Elkhorn Lake was used by more than 260 pairs in 1985, whereas 8432 North was used by 86+ pairs in 1985 and 96 pairs in 1986. The other lakes were used by less than 40 pairs.

The Central Interior accounts for roughly 35% of all known breeding pairs in B.C. (Table 17) The number of good-quality wetlands is very high, and only a fraction has been surveyed.

DISCUSSION

The lack of information on Eared Grebe breeding distribution and abundance became apparent during an attempt to obtain such information from historic records. Available data was so fragmented and covered so many years that it was impossible to get an overview of the status of the B.C. population at any given time. As a result, new surveys of adult, nests and young were conducted in 1985 and 1986. The relation between those surveys and the actual number of breeding pairs was derived from a detailed study in Central B.C. Even with our survey methods, biases could not be avoided. These biases were evaluated and assumed to be consistent for all surveys. Thus, the data collected in 1985 and 1986 allows for within and among-year analyses of population trends in different areas.

We provided an update on the distribution and abundance of Eared Grebes in B.C. Surveys conducted in 1985-1986 identified 27 new breeding lakes, for an overall estimate of 1,700-4,500 breeding pairs. Non-breeders were found on some lakes, even though they comprised only a small fraction of all birds seen during the breeding season. Marked fluctuations in numbers across years were observed for some lakes. Further information is needed in order to determine if those fluctuations are artefacts of late sampling or if they are real.

Considering the available data set and its limitations, it is impossible to discuss historical changes in Eared Grebe breeding distribution and abundance in B.C. However, the information collected in 1985 and 1986 can be used in future studies of population dynamics and distribution. Changes in land use or habitat degradation could have major impacts on large segments of the Eared Grebe population. Because of this a close watch should be kept on habitat use and population status. Because of limited resources, we could not survey all known breeding areas of the province at the peak of the breeding season. Efforts should be made to survey areas not easily accessible, because

the presence of a few very large colonies in those areas could drastically change the overall biological and management values of known breeding lakes.

Suggestions for management

1. Five lakes support roughly 60% of the total number of breeders known in B.C.: Cecil Lake, Boudreau Lake A, Little White Lake, McMurray Lakes and Westwick Lake. These lakes should be given special protective status.
2. Ten lakes account for more than 80% of the provincial population. Those lakes should be monitored annually for 3-5 years to understand annual variations.
3. Human activity can easily cause nest and young abandonment (Riske, 1975). We suggest that casual entrance and boating near colonies be controlled on all lakes used by more than 50 breeding pairs during the breeding season and that visits to nesting areas be kept to a minimum.
4. The accuracy of counts varies in relation to breeding phenology and counts carried out early in the incubation period could cause nest desertion. Care should be taken in designing survey schedules.
5. Because the abundance and distribution of breeding pairs can vary each year, breeding lakes with more than 50 pairs should be monitored every 5 years.
6. Considering the possibility that smaller colonies are related to larger colonies (either by birds of different ages or with different breeding experiences nesting in different colonies) (Breault, work in progress), some breeding lakes with small colonies should be monitored and protected.
7. Eared Grebes anchor their nests to Scirpus sp. or use submergent vegetation to build their nests. Because the effects of controlled water levels on vegetation are unknown, water level controls should not be

attempted on lakes used by more than 50 breeding pairs without proper impact studies until research shows positive benefits of water level controls.

8. We do not know the extent and significance of staging lakes used by Eared Grebes during fall migration. Research should assess the importance of the 2 staging lakes identified in this study. Protection of particularly important staging areas should be insured.
9. Inaccessible lakes should be surveyed from the air to determine their use by Eared Grebes. This would permit a better estimate of the British Columbia population.
10. Research on breeding biology of Eared Grebes should be encouraged, because of the lack of information currently available. Such research should involve: impact of predation on adult abundance and young recruitment, importance of food and habitat quality and abundance on the breeding biology, relations within and between breeding lakes, migrations and staging, moulting, etc.

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Appendix 1. List of the abbreviations used in the tables.

A	= Active colony - presence of breeding pairs.
Ad	= Adult
E	= Exact location of lake unknown, general area surveyed in 1985-1986.
I	= Inactive colony - no breeding pairs.
K	= Known location of lake, lake not surveyed in 1985-1986.
N	= Nest
P	= Pair
Pl	= Platform
U	= Unknown location of lake, lake not surveyed in 1985-1986.
UTM	= Universal Transverse Mercator
Y	= Young
-	= No data

Appendix 2.1 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

	April	May												
Lake	30	2	3	5	7	8	9	10	11	13	14	15	16	17
CENTRAL INTERIOR														
6	28	37		39	49				54	50		52		87
11	4	13		22	25		23		16	22		23		41
12	0			0	0		0		0	0		0		0
16	10	30		23	38			31	41	37			38	39
24	0	3		3	0	0	3		0	0		2	2	6
26	0	0		1	2		2		2	2		2		1
28														
40	0	5		14	14		8		14	20		33		18
South of 40					4		0		0	0		0		0
South of south of 40					3		13		14	10		12		13
42	0	0		2	5		6		3	3		2		0
53	0	0		1	0		0		0	2		4		2
Westwick			195					283						300
Sorenson			20					5						20
Coyote											11			
McMurray											449			
Elkhorn Lk.														

Appendix 2.2 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

	May												June				
	19	20	21	22	23	24	25	27	28	29	30	31	2	3	4	5	6
CENTRAL INTERIOR																	
6	99		121		106		133	138		139		107	114		84		99
11	43		38		48		41	42		35		45	38		44		38
12	0		0		0		0	0		0		0	2		4	4	4
16	39		51		44		41	43		32		18	22		16		22
24	4		2		2		0	6		8		10	15		12		16
26	0		0		8		12	10		0		2	6		2		6
28																	
40	27		10		36		38	34		31		29	34		25		11
South of 40	0		4		7		4	7		12	14	4	4	7	2	8	11
South of south of 40	16		10	26	16		14	22		13	14	14	9	24	7	14	10
42	4		4		2		7	11		9		22	18	32	23		16
53	5		4		4		0	0		4		4	4		4		4
Westwick						409						308					
Sorenson						38						36					
Coyote			12						12						6		
McMurray			680						661						806		
Elkhorn Lk.		364															

Appendix 2.3 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

Lake	June													
	7	8	9	10	11	12	13	14	15	16	18	19	24	25
CHUBB L. DENSITY														
6		66		112		71		63			88		55	
11		38		44		35		40			33		18	
12		4		2		5		2			7		0	
16		10	21	4	6	6	12	2		11		15	7	
24		17		19		30		23			19		17	
26		2		4		0		0			0		0	
28														
40		19		7		7		0		2	5		0	
South of 40		10		4		23		2		30	27	26	18	31
South at south of 40		10		4		10		8		4	9	5	14	14
42		24		9		8		7		20	15		18	12
53		2		4		5		3			2	3	4	
Westwick	446								246				315	
Sorenson	30								14				12	
Coyote					12									
McMurray					671			600						
Elkhorn Lk.		342												

Appendix 2.4 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

	June		July									
Lake	27	28	1	2	3	4	5	6	7	8	9	13
CENTRAL INTERIOR												
6		78		105							86	94
11		44		42						46		54
12		0		1		10				1		
16			9							13		10
24		30	21	25						19		19
26		0	2							0		0
28												
40		0		6				2		8		20
South of 40		20		27					6			24
South of south of 40		9		5				6	5	5		5
42		19		13					42			24
53		7		7						10		7
Westwick							230					
Sorenson							12					
Coyote											14	
McMurray	245				240						121	
Elkhorn Lk.												

Appendix 2.5 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

Lake	July							August					
	17	18	21	23	25	26	27	2	3	4	7	11	17
CENTRAL INTERIOR													
6			111				73			104	73	73	50
11	46		53				28		26		36	23	14
12							0				0	0	0
16	15		11				7		4		2	0	
24	18		14				0		0		0	0	0
26	2		9				8		4		2	3	0
28						2	2		1		5	3	2
40	24		24		9		40		32		12	14	5
South of 40	17		19		16				4		4	3	2
South of south of 40	5		6		10				3		1	0	0
42	18		16		9				5		5	6	3
53	7		6				5		4		3	2	0
Westwick								123					
Sorenson								0					
Coyote						1							0
McMurray				244									10
Elkhorn Lk.		185											

Appendix 2.6 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

Lake	April	May		June	July				August		
	29	23	29	8	10	11	14	26	1	17	18
CENTRAL INTERIOR											
8432 North		98		40			112				14
8432 South		4		58			4				2
Upper Dry Lake								98	115		35
Lower Dry Lake								55	57		7
Jamieson Meadow										1	
SOUTHERN INTERIOR											
Meadow Lake	31		329			130					
Green Lake A						5					
Green lake B	7		11			29					
Green Lake C						5					
Lake 4403	10					67					
N. OKANAGAN/KAMLOOPS											
South Separation					24						
North Separation					4						

Appendix 2.7 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

Lake	August 13	August 14	August 15
PEACE RIVER COUNTRY			
Ft. St. John potholes			4
Boundary Lake			4
Boudreau "A" Lake	29		
Cutbank Lake		0	
German Lake			1
Cecil Lake			61
"Bob Emery" Lake			5
Whispering Pine Lake			3
McQueen's Slough		8	
Sloane's Slough	0		

Appendix 3.1 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

		Central Interior								
		Lake 6								
	June 28	July 2	July 9	July 13	July 21	July 27	Aug 3	Aug 7	Aug 11	Aug 17
Age										
IA	9+	23	23	14	8	2		5		
IAB			4	1	6	13	9	1		
IB		3	12	30	12	13	17	20	8	
IBC			12	2	4		19	1		
IC		5	2	15	24	22	5	14	16	4
IC-IIA										
IIA				5	34	34	10	12	9	6
IIAB				3	4	12	2		2	
IIB				1	2	22	63	32	34	12
IIBC					1			1		
IIC							23	10		13
IIC-III									35	
III										40
Total	9+	31	53	71	95	118	148	96	104	75

Appendix 3.2 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior										
	Lake 11										
	June 28	July 2	July 8	July 13	July 17	July 21	July 27	Aug 3	Aug 7	Aug 11	Aug 17
Age											
IA	7	16	12	7	3		1	1		3	
IAB			3		2			1	4		
IB		4	5	6	10	10	1	3			2
IBC			3	6							
IC			1	13	6	5	6		1	1	
IC-IIA					1						
IIA				4	9	32	8				
IIAB					2						
IIB							23	2	1	23	1
IIBC								11	44		
IIC										13	
IIC-III											
III								23			34
Total	7	20	24	36	33	47	39	41	50	40	37

Appendix 3.3 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior								
	Lake 16								
	July 1	July 8	July 13	July 17	July 21	July 27	Aug 3	Aug 7	Aug 11
Age									
IA	3		2	3	1				
IAB		5			1	2		1	
IB		3	1	10	3	3			
IBC									
IC			2	1	1	3		3	
IC-IIA									
IIA					5	1	1		
↓IAB									
IIB						2	4	5	12
IIBC									
IIC								1	
IIC-III									
III									
Total	3	8	5	14	11	11	5	10	12

Appendix 3.4 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior											
	Lake 24											
	June 28	July 1	July 2	July 8	July 13	July 17	July 21	July 27	Aug 3	Aug 7	Aug 11	Aug 17
Age												
IA	1	6	8	2	3	1						
IAB				8	4							
IB				11	4	1						
IBC				4								
IC					18	12	5	4				
IC-⊥IA					3			3				
IIA						7	13	7				
IIAB						2	3	1				
IIB								4			1	
IIBC											5	
IIC											3	
IIC-⊥II										3	1	
III									18	17	1	5
Total	1	6	8	25	32	23	21	19	18	20	11	5

Appendix 3.5 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior					
	Lake 28					
	July 26	July 27	Aug 3	Aug 7	Aug 11	Aug 17
Age						
IA	1	1	0			
IAB						
IB				1		
IBC						
IC				2	2	
IC-IIA						
IIA						
IIAB						
IIB						
IIBC						
IIC						
IIC-III						
III						5
Total	1	1	0	3	2	5

Appendix 3.6 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior											
	Lake S of 40											
	July 2	July 7	July 13	July 16	July 17	July 21	July 25	July 27	Aug 3	Aug 7	Aug 11	Aug 17
Age												
IA	1	4	6	1				1				
IAB		4	2	2		1	1	2		1		
IB			4		4	4	1	4			1	
IBC					2							
IC			1		2	4	2	1	2	1	1	
IC-IIA						2	1					
IIA					2	1	5	1				1
IIAB									3	1	1	
IIB									9	1	1	2
IIBC										9		
IIC											11	20
IIC-III												
III												
Total	1	8	13	3	10	12	10	9	14	13	15	23

Appendix 3.7 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior									
	Lake SS of 40						Westwick Lake			Sorenson Lake
	July 21	July 25	Aug 3	Aug 7	Aug 11	Aug 17	June 24	July 5	Aug 2	July 5
Age										
IA	4						32	75		
IAB								1	5	1
IB	1	5						70	3	2
IBC								8		3
IC								5	3	3
IC-IIA			1	1						
IIA				1					11	
IIAB			3	1					1	
IIB				2					15	
IIBC					3				191	
IIC										
IIC-III										
III						0				
Total	5	5	4	5	3	0	35	158	229	9

Appendix 3.8 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Central Interior													
	Coyote Lk.		McMurray Lks.			Elkhorn Lk.	Lk. 8433 north	Upper Dry Lk.		Lower Dry Lk.			Jamieson Meadow
	July 9	July 26	July 9	Aug 2	Aug 17	July 8	Aug 18	July 31	Aug 18	July 26	July 31	Aug 18	Aug 17
Age													
IA	1	1	33	11		57				2	2		
IAB			3	6		2							
IB				104		15							
IBC				11		4							
IC				139		6							
IC-IIA				9									
IIA				16		6	6						
IIAB						3							
IIB					10	3	1					2	
IIBC													
IIC				2									
IIC-III													
III					325		18	2	17			11	6
Total	1	1	36	298	335	96	25	2	17	2	2	13	6

Appendix 3.9 Results of Eared Grebe young counts in selected colonies of British Columbia in 1985.

	Southern Interior	Northern Okanagan/ Kamloops	Peace River Country							
	Green Lk. Rd. "B"	Separation Lk. S.	Pt.St.John Potholes	Boundary Lk.	Boudreau Lk.	"A" German Lk.	Cecil Lk.	"Bob Emery" Lk.	Whispering Pine Lk.	McQueen's Slough
	July 11	July 10	Aug 15	Aug 15	Aug 13	Aug 15	Aug 15	Aug 15	Aug 15	Aug 14
Age										
IA		7								
IAB	1						1	1		
IB		5			3					
IBC	1	1			1					
IC	3	6			6					4
IC-IIA										
IIA	7			1	13					7
IIAB					2		1			
IIB	2			1	37		1			8
IIBC			1					30		
IIC					84	2				3
IIC-III			22							
III			8	76	28	9	56		23	
	14	19	31	78	174	11	59	31	23	22

Appendix 4.1 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1985.

Lake	May				June																	
	18	22	28	30	1	2	3	6	7	8	9	10	13	14	15	16	18	19	20	24	25	26	28
CRITICAL DIFFICULTY																							
Lake 6			2		14			19			43			81			77					72	
11	0		1		9			17			26		33				17						28
12								0			0		0										
16	0		0		0			1			8		11					8					
24						1		4				7		12				12					14
26						0		0				0											
28																							
40		0		0		0	0		0										0				
S of 40				0			0		0							11			14		13		
SS of 40		0		0			0		0												0		
42							0		0							0			0				
53						0			0			0		0				0					0
Westwick															80+					80+			
Coyote																							
McMurray																							
Elkhorn										262+													
8432 North																							

Appendix 4.2 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1985.

	July																Aug	
Lake	1	2	3	4	6	7	8	9	10	13	14	16	17	21	24	26	27	3	11
CENTRAL INTERIOR																			
Lake 6					38			31		18			3	0					
11		24					9			9			5	5			6	4	0
12				2			1			0			0						
16	8						4			4			0						
24		11					6			2			2	0					
26																	0		
28																1			
40							0					0							
S of 40		10				8				3			3	3			0		
SS of 40				7			8			6			5	0					
42			3			14				0			0		0				
53		1					2			2			2	1			3	1	0
Coyote									8										
McMurray		343+																	
		15p+																	
8432 North											72+								
											14p+								
Upper Dry Lk.																3+			
Lower Dry Lk.																35+			

Appendix 4.3 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1985.

Lake	July 11	July 27*	July 28*
SOUTHERN INTERIOR			
Meadow Lake	40+ 25p+		
Green Lake Rd."A"	4+		
Green Lake Rd. "B"	4+ 15p+		
Lake 4403	46+		
PEACE RIVER COUNTRY			
Ft. St. John Potholes		3+	
Cecil Lake			1+ 13p+

* Surveys conducted by Bob Emery.

Appendix 5.1 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1986.

	Central Interior													
	May													
Lake	4	5	6	7	8	10	11	13	14	15	16	18	19	20
6	49			52		42		75			86		108	
11	14	8		14		11		9		18	25		21	
12	0			0		0		0			0		3	3
16	18			18		13		20			23		26	
24	0			2		5		0			2	0	4	
26	0	1		1		3		6			2		4	
28	0			0		0		0			2		0	
40	1			5		8		5			7		15	
South of 40	1		0	0		8		2	1	3	5		7	5
South of south of 40	4		8	1		0		0	1	0	0		0	
42	2			2	2	2		0			0		4	
53	0			0		0		2			0	0	0	
Westwick				94				213						
Sorenson				9				12						
Coyote							18							
McMurray							178							

Appendix 5.2 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

	Central Interior															
	May									June						
Lake	21	22	23	24	25	27	28	30	31	2	3	5	6	8	9	10
6		126		165	162		150		125		146		121		104	
11		28			27		20		14		6		10		22	
12	1	0			4		3	2	22		17		32	37	13	
16		27			29		39		29		42		26		21	
24	0	8			4		0		3		7	1	7		14	14
26		0			5		18		13		17	23	10		2	
28		0			6		0		0		0		0		1	
40		17			23		32		17		15		12		13	
South of 40		2			1	2	0		4		5		11		10	15
South of south of 40		0			0		1		7	9	3		1		2	
42	14	10	10		12		8		4		4		4		9	13
53		0			0		0		0		0		0		0	
Westwick		293										381				
Sorenson		28										7				
Coyote						8										
McMurray						234										

Appendix 5.3 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1986.

	Central Interior													
	June													
Lake	12	13	14	15	16	18	19	21	22	23	24	26	27	30
6	154			113		130		111			139		92	48
11	4			5		2		0			5		17	17
12	22			20		35		26			48		20	15
16	23			20		28		13	14		5		8	16
24	12			4		6		0			0		0	0
26	2	0		7		5		13			14		7	12
28	1	0		0		0		4			0		0	0
40	11			6		5		13			9		6	13
South of 40	6			15		13	12	5		12	9	9	7	8
South at south of 40	2			1		4	8	6			4		4	2
42	7		15	6		20		20			30		14	6
53	2	2		2		2		3			2		2	0
Westwick					253		43+							
Sorenson					0		9							
Coyote														
McMurray														

Appendix 5.4 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1986.

	Central Interior																			
	July																			
Lake	1	2	3	4	5	6	7	8	9	10	11	12	15	16	18	19	20	21	28	29
6			60			55			57			70	67		45			83		
11			16			13			18			12	16		21			26		
12			0			4		13				7	1		10					
16		2+				11			10			6	1		2		1	2		
24			1			0			0			0	0		0					
26			16	12		14			5			12	10		9			6		
28			0			0			0			0	0		0			0		
40			9			8		13	8			8	16		7			9		
South of 40			5			7		10				11	8		10	9		11	6	1
South of south of 40			0			0						0	0		0			0	0	
42	21		23		34	19			11			6	19		11		1	3		
53			0						4		7	9	6	6	6		8	7		
Westwick			233							297										
Sorenson			0							0										
Coyote						1														
McMurray						374														

Appendix 5.5 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1986.

	Central Interior							
	August							
Lake	1	12	14	15	18	20	24	28
6	29	5	2			4		
11	48	28				11		
12	13	6	4			0	0	
16		0	0		0	0	0	0
24	0	0	0			0	0	
26	13		11			6	2	
28	0	0				0		
40	4	0				1		
South of 40	0	0				0		
South of south of 40	0	0				0		
42	7	16	37			30		
53	2	6	7			5	4	
Westwick	355			36				
Sorenson								
Coyote						0		
McMurray						20		

Appendix 5.6 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1985.

Lake	May 3	May 9	May 12	June 1	June 15	July 18	July 24	August 6	August 17
CENTRAL INTERIOR									
Elkhorn								119	
8432 North			6						15
8432 South			2						
Upper Dry Lake					56				26
Lower Dry Lake					16				2
Dry Lake #3									5
Jamieson Meadow		5		2					6
Golden Pond								2	
Soda Lake I&J							7		
SOUTHERN INTERIOR									
Meadow Lake	107					133			
Green Lake Rd. "A"	0					4			
Green Lake Rd. "B"	0					5			
Green Lake Rd. "C"	0								
Little White Lake						451			
Lake 4403	0					42			

Appendix 5.7 Results of Eared Grebe adult counts in selected colonies of British Columbia in 1986.

Lake	July 16	July 17	July 25	July 26	July 27	July 28	July 29
KAMLOOPS/OKANAGAN							
Separation Lk. South	47						
Separation Lk. North	9						
Stump Lake	67						
Rawlings Lake	49						
Kamloops "A"	7						
tunkwa Lake #3		2					
PEACE RIVER COUNTRY							
Fort St. John Potholes			3				
Boundary Lakes					33		
Boudreau "A" Lake							339
Cutbank Lake							55
German Lake					14		
Cecil Lake				534			
Whispering Pine			0				
McQueen's Slough						59	
Sloane's Slough							0

Appendix 6.1 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Central Interior								
	Lake 11			Lake 12					
	Aug 1	Aug 12	Aug 20	Aug 1	Aug 12	Aug 14	Aug 20	Aug 21	Aug 24
Age									
IA	4								
IAB	4	3		3					
IB	8	1	3		2				
IBC	3					1			
IC		2	2		2	2			
IC-IIA									
IIA		10	8		3	3			
IIAB									
IIB		4			1		8	3	
IIBC								2	
IIC			30						
IIC-III									
III								1	9
Total	19	20	43	3	8	6	8	6	9

Appendix 6.2 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Central Interior													
	Lake 16													
	June 27	June 30	July 6	July 9	July 12	July 15	July 20	July 21	Aug 12	Aug 14	Aug 18	Aug 20	Aug 24	Aug 18
Age														
IA	2+	8+												
IAB			2											
IB			5	2	2			1+						
IBC														
IC						1	1+							
IC-IIA														
IIA														
IIAB														
IIB										1				
IIBC														
IIC									2					
IIC-III														
III											4	3	4	6
Total	2+	8+	7	2	2	1	1+	1+	2	1	4	3	4	6

Appendix 6.3 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Central Interior									
	Lake 26					Lake 42				
	Aug 1	Aug 7	Aug 14	Aug 20	Aug 24	Aug 1	Aug 12	Aug 14	Aug 20	Aug 27
Age										
IA										
IAB						1				
IB	14						4	14		
IBC										
IC		3+	2				12	26		
IC-IIA										
IIA			8	7			5	1	18	
IIAB			1							
IIB				1					8	
IIBC					14					2
IIC				5						3
IIC-III										2
III										2
Total	14	3+	11	13	14	1	21	41	26	9

Appendix 6.4 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Central Interior												
	Lake 53					Westwick Lk.				Coyote Lk.	McMurray Lk.		Elkhorn Lk.
	Aug 12	Aug 14	Aug 20	Aug 24	Aug 25	July 3	July 10	Aug 1	Aug 15	Aug 20	July 7	Aug 20	Aug 6
Age													
IA						2	14	21			45		5
IAB						27	8	4			42		10
IB	4					24	47	81			152		14
IBC		2		1		2			3				
IC	1	1	1				24	47	6		86	4	28
IC-IIA												20	
IIA		5	7					73			20	2	34
IIAB		2											
IIB					1			7	4		7	1	2
IIBC					1				140				
IIC				9	1						13	2	1
IIC-III					2								
III										8		60	1
Total	5	10	8	10	5	55	93	233	153	8	365	89	95

Appendix 6.5 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Central Interior					Southern Interior			
	8432 North	Dry Lk. 3	Jamieson Meadow	Golden Pond	Soda Lk. "I"&"J"	Meadow Lk.	Green Lk. Rd. "B"	Little White Lk.	Lake 4403
	Aug 17	Aug 17	Aug 17	Aug 6	July 24	July 18	July 18	July 18	July 18
Age									
IA	2			1	3	4		7	7
IAB									
IB			1		1			29	9
IBC	1				1				
IC	1							51	4
IC-IIA									
IIA	1	2	1	2				371	
IIAB								12	
IIB	21	3	16					84	
IIBC					1		9		
IIC	12							4	
IIC-III									
III	1								
Total	39	5	18	3	6	4	9	558	20

Appendix 6.6 Results of Eared Grebe young counts in selected colonies of British Columbia in 1986.

	Northern Okanagan-Kamloops			Peace River Country					
	South Separation Lk.	Rawlings Lk.	Kamloops 'A'	Boundary Lk.	Boudreau "A" Lk.	Outbank Lk.	Cecil Lk.	McQueen's Slough	Sloane's Slough
	July 16	July 16	July 16	July 27	July 29	July 29	July 26	July 28	July 29
Age									
IA						6	48		
IAB			1		1		6		
IB	4		2	2	9	15	176	3	
IBC		1			1				
IC	13	1	2	1	15	1	115	2	
IC-±IA									
IIA	21	2	2	17	18		31	24	
±IAB			2						
IIB	8			175	70	1	21	27	
IIBC									
IIC								4	
IIC-±II									7
III									
Total	46	4	9	195	114	23	397	60	7

Appendix 7.1 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1985.

	May			June															
	29	30	31	2	4	5	6	7	8	9	10	12	13	14	15	16	18	19	20	22
CENTRAL INTERIOR																				
Lake #6			2		0				0										0	
11		0			0				0			0					0			
12		0			0				6			1					15		15	
16	3		7	13				14			21			27			28			10
24						0				1			1				0			
26						0														
40			0				0				0			0						
S of 40							0				0			0				0		
SS of 40				0			0							0	0			0		
42							0							0				2		
53													0							
Westwick						15+										206+		94+		
Coyote																				
McMurray																				
Elkhorn																				
8432 North																				
Dry Lake 3																				

Appendix 7.2 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1986.

	June							July												
Lake	23	24	25	27	28	29	30	1	2	3	4	5	7	8	9	10	13	16	19	20	21
CENTRAL INTERIOR																					
Lake #6																					37
11				1					6											21	
12		19			14				0					5							
16				10		8								1							
24			0								0									0	
26			0			0					0				7		7				5
40														0						0	
S of 40	0			3				5											2		
SS of 40	0			0				0				0									
42	0							2				1								17	
53						0									2		4	2		3	
Westwick										93+						62+					
Coyote																					
McMurray													47+								
													371p+								
Elkhorn																					
8432 North																					
Dry Lake 3																					

Appendix 7.3 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1986.

Lake	July			August				
	22	28	30	2	7	14	17	20
CENTRAL INTERIOR								
Lake #6								
11						0		
12		13		5				
16			13	1		0		
24								
26								
40						0		
S of 40								
SS of 40								
42						0		
53						0		
Westwick								
Coyote								
McMurray								6p
Elkhorn	60+							20p+
8432 North								
Dry Lake 3					21p+			
							1+	

Appendix 7.4 Results of Eared Grebe nest counts in selected colonies of British Columbia in 1986.

Lake	July 16	July 18	July 26	July 28	July 29
SOUTHERN INTERIOR					
Meadow Lake		37+			
Green Lake A		1+			
		2p+			
Green Lake B		1+			
		5p+			
Lake 4403		6+			
		30p+			
OKANAGAN/KAMLOOPS					
Stump Lake	61+				
	13p+				
PEACE RIVER					
Boudreau "A" Lake					3+
					15p+
Cutbank Lake					5+
					5p+
Cecil Lake			99+		
			205p+		
McQueen's Lake				12+	

Appendix 8.1 Mercator locations of lakes surveyed in 1985 and 1986 in the Peace River area.

Topo map no.	Mercator coordinates	Status in 1985-1986
93 P/8	10.6837-61448	I[1]
93 P/8	10.6840-61340	A
93 P/8	10.6849-61383	I
93 P/9	10.6756-61664	I
93 P/9	10.6765-61655	I
93 P/9	10.6834-61658	I
93 P/9	10.6885-61559	I
93 P/11	10.6010-61750	I
93 P/11	10.6020-60753	I
93 P/13	10.5936-61848	I
93 P/14	10.5990-61935	I
93 P/15	10.6313-61873	I
93 P/15	10.6388-61868	A
93 P/15	10.6390-61836	I
93 P/15	10.6487-61826	I
93 P/16	10.6746-61947	I
93 P/16	10.6775-61872	A
94 A/3	10.6030-62250	A
94 A/3	10.6098-62135	I
94 A/7	10.6250-62430	A
94 A/7	10.6373-62383	A
94 A/7	10.6393-62465	A
94 A/7	10.6490-62450	A
94 A/8	10.6820-62520	A
94 A/8	10.6850-62480	A
94 A/8	10.6850-62580	I
94 A/10	10.6236-62706	I
94 A/10	10.6240-62725	A
94 A/10	10.6278-62695	I
94 A/10	10.6302-62655	A

1 List of abbreviations is given in Appendix 1.

Appendix 8.2 Mercator locations of lakes surveyed in 1985 and 1986 in the southern interior area.

Topo map no.	Mercator coordinates	Status in 1985-1986	Topo map no.	Mercator coordinates	Status in 1985-1986
92 P/4	10.5857-56509	I	92 P/6	10.6138-56853	I
92 P/4	10.5918-56539	I	92 P/6	10.6138-56912	I
92 P/4	10.5925-56550	I	92 P/6	10.6140-56916	I
92 P/4	10.5985-56592	I	92 P/6	10.6140-56937	I
92 P/4	10.5987-56589	I	92 P/6	10.6141-56920	I
92 P/4	10.5989-56587	I	92 P/6	10.6141-56936	I
92 P/4	10.5990-56765	I	92 P/6	10.6145-56850	I
92 P/4	10.5992-56586	I	92 P/6	10.6147-56858	A
92 P/4	10.5992-56588	I	92 P/6	10.6150-56853	A
92 P/4	10.5999-56576	I	92 P/6	10.6151-56856	A
92 P/4	10.6007-56570	I	92 P/6	10.6156-56857	I
92 P/4	10.6015-56564	I	92 P/6	10.6160-56870	I
92 P/4	10.6017-56540	I	92 P/6	10.6165-56878	I
92 P/4	10.6017-56550	I	92 P/6	10.6171-56883	I
92 P/4	10.6018-56545	I	92 P/6	10.6176-56889	I
92 P/4	10.6020-56532	I	92 P/6	10.6179-56929	I
92 P/5	10.5730-56943	I	92 P/15	10.5860-56910	A
92 P/5	10.5748-56941	I	92 P/15	10.5890-56906	A
92 P/5	10.5754-56943	I	92 P/15	10.5891-56811	I
92 P/5	10.5785-56940	I	92 P/15	10.5896-56810	I
92 P/5	10.5810-56936	I	92 P/15	10.5915-56815	A
92 P/5	10.5824-56926	I	92 P/15	10.5945-56872	I
92 P/5	10.5885-56810	I	92 P/15	10.5965-56810	I
92 P/5	10.5925-56903	I			
92 P/5	10.5934-56898	I			
92 P/5	10.5935-56810	I			
92 P/5	10.5935-56885	I			
92 P/5	10.5940-56870	I			
92 P/5	10.5978-56800	I			
92 P/6	10.6068-56794	I			
92 P/6	10.6110-56839	I			
92 P/6	10.6118-56838	I			
92 P/6	10.6125-56846	I			
92 P/6	10.6125-56896	I			
92 P/6	10.6126-56864	I			
92 P/6	10.6126-56868	I			
92 P/6	10.6128-56999	I			
92 P/6	10.6128-57008	I			
92 P/6	10.6132-57031	I			
92 P/6	10.6133-56849	I			
92 P/6	10.6133-56909	I			
92 P/6	10.6134-56908	I			
92 P/6	10.6135-56012	I			
92 P/6	10.6136-56851	I			

1 List of abbreviations is given in Appendix 1.

Appendix 8.3 Mercator locations of lakes surveyed in 1985 and 1986 in the northern Okanagan/Kamloops area.

Topo map no.	Mercator coordinates	Status in 1985-1986
82 L/6	11.3297-55927	I[1]
82 L/6	11.3322-55904	I
82 L/6	11.3323-55912	I
82 L/6	11.3327-55898	I
82 L/6	11.3366-55816	I
82 L/6	11.3374-55811	I
82 L/6	11.3395-55760	A
82 L/7	11.3663-55705	A
92 I/8	10.6870-55820	I
92 I/8	10.6899-55856	I
92 I/8	10.6902-55860	I
92 I/8	10.6904-55857	I
92 I/8	10.6905-55828	I
92 I/8	10.6916-55888	I
92 I/8	10.6919-55908	I
92 I/8	10.6940-55940	I
92 I/9	10.6771-56157	I
92 I/9	10.6780-56158	I
92 I/9	10.6790-56157	I
92 I/9	10.6800-56153	I
92 I/9	10.6803-56130	I
92 I/9	10.6806-56109	I
92 I/9	10.6807-56104	I
92 I/9	10.6807-56109	I
92 I/9	10.6808-56113	I
92 I/9	10.6808-56118	I
92 I/9	10.6813-56154	I
92 I/9	10.6825-56095	I
92 I/9	10.6850-56144	I
92 I/9	10.6901-56091	I
92 I/9	10.6915-56062	I
92 I/9	10.6917-56072	A
92 I/9	10.6917-56079	I
92 I/9	10.6918-56054	I
92 I/9	10.6918-56054	I
92 I/9	10.6918-56062	I
92 I/9	10.6918-56063	A
92 I/9	10.6920-56079	I
92 I/9	10.6921-56080	I
92 I/9	10.6922-56046	I
92 I/9	10.6924-56047	I
92 I/9	10.6924-56048	I
92 I/9	10.6925-56048	I
92 I/9	10.6928-56072	I
92 I/9	10.6934-56113	A
92 I/9	10.6937-56077	I
92 I/9	10.6939-56078	I
92 I/9	10.6939-56080	I
92 I/9	10.6939-56094	I
92 I/9	10.6940-56067	I
92 I/9	10.6940-56100	I
92 I/9	10.6942-56080	I
92 I/9	10.6942-56113	I
92 I/9	10.6944-56088	I
92 I/9	10.6948-56070	I
92 I/9	10.6950-56000	I
92 I/9	10.6950-56091	I
92 I/10	10.6525-56069	I
92 I/10	10.6528-56067	I
92 I/10	10.6540-56077	I
92 I/10	10.6579-56231	I
92 I/10	10.6581-56235	I
92 I/10	10.6584-56230	I
92 I/10	10.6595-56227	I
92 I/10	10.6605-56227	I
92 I/10	10.6621-56136	I
92 I/10	10.6737-56144	I
92 I/10	10.6741-56150	I
92 I/10	10.6745-56148	I
92 I/10	10.6751-56149	I
92 I/10	10.6758-56149	I

1 List of abbreviations is given in Appendix 1.

Appendix 8.4 Mercator locations of lakes surveyed in 1985 and 1986 in the central interior area.

Topo map no.	Mercator coordinates	Status in 1985-1986	Topo map no.	Mercator coordinates	Status in 1985-1986
92 O/11	10.4968-57318	I	92 O/16	10.5380-57609	I
92 O/14	10.4734-57441	I	92 O/16	10.5384-57558	I
92 O/14	10.4779-57425	I	92 O/16	10.5385-57598	I
92 O/14	10.4790-57400	I	92 O/16	10.5386-57605	A
92 O/14	10.4800-57474	I	92 O/16	10.5386-57616	A
92 O/14	10.4806-57652	I	92 O/16	10.5387-57619	A
92 O/14	10.4820-57390	I	92 O/16	10.5388-57621	I
92 O/14	10.4830-57386	I	92 O/16	10.5389-57616	I
92 O/14	10.4835-57389	I	92 O/16	10.5390-57609	A
92 O/14	10.4855-57383	I	92 O/16	10.5392-57600	I
92 O/14	10.4874-57386	A	92 O/16	10.5393-57585	I
92 O/14	10.4886-57386	I	92 O/16	10.5393-57604	I
92 O/14	10.4886-57387	I	92 O/16	10.5399-57593	I
92 O/14	10.4887-57382	I	92 O/16	10.5400-57580	A
92 O/14	10.4887-57382	A	92 O/16	10.5409-57564	I
92 O/14	10.4905-57370	I	92 O/16	10.5413-57575	I
92 O/14	10.4915-57366	I	92 O/16	10.5420-57570	I
92 O/14	10.4950-57350	I	92 O/16	10.5427-57563	I
92 O/14	10.4950-57437	I	92 O/16	10.5435-57554	I
92 O/14	10.4953-57390	I	92 O/16	10.5448-57580	I
92 O/14	10.4956-57388	I	92 O/16	10.5455-57550	I
92 O/14	10.4965-57331	I	92 O/16	10.5458-57553	I
92 O/14	10.4984-57452	A	92 O/16	10.5570-57610	A
92 O/14	10.4995-57450	A	92 O/16	10.5580-57600	A
92 O/16	10.5340-57342	I	92 O/16	10.5588-57557	I
92 O/16	10.5343-57636	I	92 O/16	10.5593-57472	I
92 O/16	10.5344-57588	A	92 O/16	10.5600-57480	I
92 O/16	10.5347-57620	I	92 O/16	10.5600-57550	I
92 O/16	10.5350-57625	I	92 O/16	10.5601-57478	I
92 O/16	10.5359-57629	I	92 O/16	10.5604-57488	I
92 O/16	10.5360-57599	I	92 O/16	10.5604-57492	I
92 O/16	10.5360-57640	I	92 O/16	10.5608-57525	I
92 O/16	10.5361-57634	I	92 O/16	10.5610-57536	I
92 O/16	10.5362-57604	I	92 O/16	10.5615-57525	I
92 O/16	10.5363-57596	I	92 O/16	10.5616-57534	I
92 O/16	10.5363-57610	I	92 P/11	10.5870-57510	I
92 O/16	10.5363-57621	I	92 P/11	10.5886-57490	I
92 O/16	10.5363-57636	I	92 P/11	10.5896-57487	I
92 O/16	10.5363-57642	I	92 P/11	10.5897-57482	I
92 O/16	10.5367-57611	I	92 P/11	10.5910-57429	I
92 O/16	10.5370-57620	I	92 P/11	10.5910-57475	I
92 O/16	10.5372-57607	I	92 P/11	10.5915-57396	I
92 O/16	10.5373-57616	I	92 P/11	10.5918-57467	I
92 O/16	10.5375-57615	A	92 P/11	10.5920-57428	I
92 O/16	10.5377-57590	I	92 P/11	10.5922-57413	I
92 O/16	10.5378-57596	I	92 P/11	10.5925-57412	I
92 O/16	10.5379-57599	I	92 P/11	10.5940-57380	I

Appendix 8.4 Mercator locations of lakes surveyed in 1985 and 1986 in the central interior area.

Topo map no.	Mercator coordinates	Status in 1985-1986	Topo map no.	Mercator coordinates	Status in 1985-1986
92 P/11	10.6095-57324	I	93 B/1	10.5616-57804	I
92 P/11	10.6131-57066	I	93 B/1	10.5620-57850	I
92 P/11	10.6135-57335	I	93 B/1	10.5627-57821	I
92 P/11	10.6136-57067	I	93 B/2	10.5263-57793	I
92 P/11	10.6139-57324	I	93 B/2	10.5290-57767	I
92 P/11	10.6145-57295	I	93 B/2	10.5290-57853	I
92 P/11	10.6146-57141	I	93 B/2	10.5293-57773	I
92 P/11	10.6156-57304	I	93 B/2	10.5294-57849	I
92 P/11	10.6160-57293	I	93 B/2	10.5297-57695	I
92 P/11	10.6175-57272	I	93 B/2	10.5310-57850	I
92 P/11	10.6176-57222	I	93 B/2	10.5320-57883	I
92 P/11	10.6181-57253	I	93 B/2	10.5326-57887	I
92 P/14	10.5886-57489	I	93 B/2	10.5334-57873	I
92 P/14	10.5897-57487	I	93 B/2	10.5335-57773	I
92 P/14	10.5898-57482	I	93 B/2	10.5336-57868	I
92 P/14	10.5908-57475	I	93 B/3	10.4809-57760	I
92 P/14	10.6073-57368	I	93 B/3	10.4817-57767	A
92 P/14	10.6080-57368	I	93 B/3	10.4825-57740	I
92 P/14	10.6093-57441	I	93 B 7	10.5235-57915	I
92 P/14	10.6094-57350	I	93 B 7	10.5302-57896	I
92 P/14	10.6094-57418	I	93 B 7	10.5320-57890	I
92 P/14	10.6097-57351	I	93 B 7	10.5438-57660	I
92 P/14	10.6098-57349	I	93 B 7	10.5450-57835	I
92 P/14	10.6099-57345	I	93 B 7	10.5466-57877	I
92 P/14	10.6102-57411	I	93 B/8	10.5392-57915	I
92 P/14	10.6103-57402	I	93 B/8	10.5430-57895	I
92 P/14	10.6107-57338	I	93 B/8	10.5435-57900	I
92 P/14	10.6114-57395	I	93 B/8	10.5445-57910	A
92 P/14	10.6116-57393	I	93 B/8	10.5457-58082	I
92 P/14	10.6126-58368	I	93 B/8	10.5480-58064	I
92 P/14	10.6130-58369	A	93 B/8	10.5495-58029	I
92 P/14	10.6140-57357	I	93 B/8	10.5511-57971	I
92 P/14	10.6140-57374	I			
92 P/14	10.6143-57357	I			
92 P/14	10.6145-57372	I			
92 P/14	10.6146-57324	I			
92 P/14	10.6148-57380	I			
92 P/14	10.6150-57360	I			
93 B/1	10.5345-57886	I			
93 B/1	10.5360-57870	I			
93 B/1	10.5410-57900	I			
93 B/1	10.5415-57887	A			
93 B/1	10.5428-57858	I			
93 B/1	10.5581-57631	I			

1 List of abbreviations is given in Appendix 1.